

WE CLAIM:

1. An instrumentation system, comprising:
  - a chassis, comprising:
    - 5 a plurality of slots, wherein each of the plurality of slots is operable to receive an inserted module;
    - a backplane, comprising:
      - a switched fabric bus; and
      - 10 a plurality of instrumentation signaling lines which provide instrumentation signaling functions; and
      - a plurality of interface connectors coupled to the backplane, wherein each of the connectors is operable to connect to a respective inserted module;
      - 15 wherein the backplane is operable to provide for communication among the inserted modules.
2. The instrumentation system of claim 1, wherein the switched fabric bus is a channel based switched fabric bus.
3. The instrumentation system of claim 2, wherein the channel based switched fabric bus is the InfiniBand bus.
4. The instrumentation system of claim 1, wherein the switched fabric bus includes one or more routers and/or switches which are operable to selectively provide for communication between the inserted modules.
- 25 5. The instrumentation system of claim 1, wherein the plurality of instrumentation signaling lines include:

at least one local bus, wherein the at least one local bus provides for adjacent slot communication for one or more of analog signals or digital signals.

6. The instrumentation system of claim 5, wherein the at least one local bus  
5 is operable to connect each of at least a subset of the plurality of slots with its adjacent slots, wherein the at least one local bus is operable to provide a communication path between the inserted modules for one or more of analog signals or side-band digital communications.

10 7. The instrumentation system of claim 1, wherein the plurality of instrumentation signaling lines include:

one or more lines for transmitting one or more system reference clock signals, wherein the one or more system reference clock signals are operable to provide synchronization signals for the inserted modules.

15 8. The instrumentation system of claim 7, wherein the reference clock signals are generated by a reference clock comprised on one or more of the backplane, one of the inserted modules, or an external system which is coupled to one of the inserted modules.

20 9. The instrumentation system of claim 8, wherein the reference clock comprises a differential clock.

10. The instrumentation system of claim 8, wherein the reference clock comprises a fixed frequency reference clock.

25 11. The instrumentation system of claim 8, wherein the reference clock comprises a variable frequency reference clock.

12. The instrumentation system of claim 7, wherein the reference clock signals are generated by two or more reference clocks comprised on one or more of the backplane, one of the inserted modules, or an external system which is coupled to one of the inserted modules.

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13. The instrumentation system of claim 1, wherein the plurality of instrumentation signaling lines include:

a trigger bus, wherein the trigger bus comprises a plurality of trigger lines, wherein each of the plurality of trigger lines is operable to connect a respective one of the plurality of slots to the trigger bus, and wherein the trigger bus is operable to communicate trigger signals between the inserted modules.

14. The instrumentation system of claim 13, wherein the trigger bus comprises at least one open-collector signal line.

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15. The instrumentation system of claim 1, further comprising:

a star trigger controller slot, wherein the star trigger controller slot is operable to receive an inserted star trigger controller module;

wherein the plurality of instrumentation signaling lines include a star trigger bus, wherein the star trigger bus comprises a plurality of dedicated trigger lines, each connecting the star trigger controller slot to one of the plurality of slots, wherein the star trigger bus is operable to communicate precision trigger signals between the inserted star trigger controller module and in each of the inserted modules in the plurality of slots.

25 16. The instrumentation system of claim 15, wherein at least a subset of said dedicated trigger lines comprise one or more differential triggers.

17. The instrumentation system of claim 15, wherein each of the dedicated trigger lines is of equal length to provide matched propagation times of the trigger signals.

5 18. The instrumentation system of claim 1, wherein the plurality of instrumentation signaling lines include a low voltage analog bus.

19. The instrumentation system of claim 1, wherein the plurality of instrumentation signaling lines include a high voltage analog bus.

10 20. The instrumentation system of claim 1, wherein the plurality of instrumentation signaling lines include one or more of:

15 a local bus;  
system reference clock signals;  
a trigger bus; and  
a star trigger bus.

21. The instrumentation system of claim 1, wherein the plurality of instrumentation signaling lines include two or more of:

20 a local bus;  
system reference clock signals;  
a trigger bus; and  
a star trigger bus.

25 22. The instrumentation system of claim 1, wherein the plurality of instrumentation signaling lines include three or more of:

a local bus;  
system reference clock signals;

a trigger bus; and

a star trigger bus.

23. The instrumentation system of claim 1, wherein the plurality of  
5 instrumentation signaling lines include two or more of:

a local bus;

system reference clock signals;

a trigger bus;

a star trigger bus;

10 a low voltage analog bus; and

a high voltage analog bus.

24. The instrumentation system of claim 1, further comprising:

one or more instrumentation modules, wherein each of the one or more  
15 instrumentation modules is operable to be inserted into a respective one of the plurality of  
slots, wherein the backplane is operable to logically couple to each of the one or more  
instrumentation modules when inserted into the slots;

wherein each of the one or more instrumentation modules is operable to perform  
instrumentation functions in the instrumentation system.

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25. The instrumentation system of claim 1, further comprising:

a system controller slot, wherein the system controller slot is operable to receive  
an inserted system controller module, wherein the inserted system controller module is  
operable to provide system controller functions in the instrumentation system.

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26. The instrumentation system of claim 25, wherein the system controller  
module comprises a computer module, wherein the computer module is operable to  
provide computer functions in the instrumentation system.

27. The instrumentation system of claim 25, wherein the system controller module comprises an interface for coupling to an external system.

5 28. The instrumentation system of claim 27, wherein the external system comprises a computer system.

29. The instrumentation system of claim 1, further comprising:  
one or more additional chassis coupled to said chassis via a transmission medium,  
10 each of said additional chassis comprising:  
a plurality of slots, wherein each of the plurality of slots is operable to receive an inserted module;  
a backplane, comprising:  
a switched fabric bus; and  
15 a plurality of instrumentation signaling lines which provide instrumentation signaling functions;  
a plurality of interface connectors coupled to the switched fabric bus and to the plurality of lines, wherein each of the connectors is operable to connect to a respective inserted module;  
20 wherein the backplane is operable to provide for communication among the inserted modules.

30. The instrumentation system of claim 29,  
wherein the plurality of signaling lines of said chassis are operable to transmit  
25 instrumentation signals through the transmission medium to said one or more additional chassis, and wherein the plurality of instrumentation signaling lines of said one or more additional chassis are operable to provide the instrumentation signals to one or more inserted modules in said one or more additional chassis.

31. The instrumentation system of claim 29,  
wherein said plurality of signaling lines of each of said chassis and said one or  
more additional chassis are operable to communicate instrumentation signals through the  
5 transmission medium with any others of said chassis and said one or more additional  
chassis, thereby providing for communication between inserted modules of any of said  
chassis and said one or more additional chassis.

32. The instrumentation system of claim 29,  
10 wherein the transmission medium comprises one or more transmission cables; and  
wherein said chassis and said one or more additional chassis are daisy-chained  
together by said one or more transmission cables, respectively.

33. The instrumentation system of claim 29,  
15 wherein the transmission medium comprises a network.

34. The instrumentation system of claim 33,  
wherein the network comprises the Internet.

20 35. An instrumentation system, comprising:  
a computer system;  
a chassis;  
a cable coupling the computer system and the chassis, wherein the cable transmits  
switched fabric bus signals between the computer system and the chassis;  
25 wherein the chassis comprises:  
a plurality of slots, wherein each of the plurality of slots is operable to  
receive an inserted module;  
a backplane, comprising:

a switched fabric bus; and  
a plurality of instrumentation signaling lines which provide instrumentation signaling functions;

5 a plurality of interface connectors coupled to the switched fabric bus and to the plurality of lines, wherein each of the connectors is operable to connect to a respective inserted module;

wherein the backplane is operable to provide for communication among the inserted modules.

10 36. The instrumentation system of claim 35, wherein the plurality of instrumentation signaling lines include one or more of:

a local bus;  
system reference clock signals;  
a trigger bus; and  
15 a star trigger bus.

37. The instrumentation system of claim 35, wherein the plurality of instrumentation signaling lines include one or more of:

20 a local bus;  
system reference clock signals;  
a trigger bus;  
a star trigger bus;  
a low voltage analog bus; and  
a high voltage analog bus.

25 38. The instrumentation system of claim 35,  
wherein the switched fabric bus is a channel based switched fabric bus.

39. The instrumentation system of claim 38, wherein the channel based switched fabric bus is the InfiniBand bus.

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